MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

BMT1814 – MANAGERIAL MATHEMATICS

(All Sections / Groups)

16 OCTOBER 2017
9.00 a.m. - 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 6 pages, inclusive of a list of formulae.
2. Attempt all 4 questions. The distribution of marks for each question is given.
3. Students are allowed to use scientific calculators.
4. Please write your answers in the **Answer Booklet** provided.

Question 1 (25 marks)

a) Find an equation of the line that passes through the point (1, -2) and is perpendicular to the line passing through the points (-2, -1) and (4, 3).

[6 marks]

b) A network server has an original value of $10,000 and is to be depreciated linearly over 5 years with a $3,000 scrap value. Find an expression giving the book value at the end of year t. What will be the book value of the server at the end of the second year?

[7 marks]

c) Solve the following linear programming problem using the corner point method.

$$\begin{aligned} &Min \quad C = 6x + 8y \\ &\text{subject to} \quad 40x + 10y \geq 2400 \\ &\qquad\qquad\quad 10x + 15y \geq 2100 \\ &\qquad\qquad\quad 5x + 15y \geq 1500 \\ &\qquad\qquad\quad x, y \geq 0 \end{aligned}$$

[12 marks]

Question 2 (25 marks)

a) An amount of $2,000 is invested in a 10-year trust fund that pays 6% annual simple interest. What is the total amount of the trust fund at the end of 10 years?

[3 marks]

b) How many years will it take $12,000 to grow to $15,000 if the investment earns interest at the rate of 8% compounded monthly?

[6 marks]

c) After making a down payment of $6,000 for an automobile, Murphy paid $600 per month for 36 months with interest charged at 6% per year compounded monthly on the unpaid balance. How much was the unpaid balance?

[6 marks]

Continued....

d) The Blakelys borrowed $120,000 from a bank to help finance the purchase of a house. The bank charges interest at a rate of 5.4% per year on the unpaid balance, with interest computations made at the end of each month. The Blakelys have agreed to repay the loan in equal monthly instalments over 30 years. How much should each payment be if the loan is to be amortized at the end of the term?

[5 marks]

e) In 10 years, a $40,000 machine will have a salvage value of $4000. A new machine at that time is expected to sell for $52,000. In order to provide funds for the difference between the replacement cost and the salvage value, a sinking fund is set up into which equal payments are placed at the end of each year. If the fund earns 7% compounded annually, how much should each payment be?

[5 marks]

Question 3 (25 marks)

a) Find the first derivative of the following functions:

(i) $f(x)=2x^3-3x^2+2x-3$ **[2 marks]**

(ii) $g(x)=2\sqrt{x}+\frac{3}{\sqrt{x}}$ **[3 marks]**

(iii) $f(x)=\frac{\ln x}{x}$ **[5 marks]**

b) An industrial asset is being depreciated at a rate so that its book value t years from now will be

$$V(t)=50,000e^{-0.4t}$$

dollars. How fast will the book value of the asset be changing 3 years from now?

[5 marks]

c) For the following function: $f(s,t)=\left(s^2-st+t^2\right)^5$

(i) Find the first partial derivatives, f_s and f_t. **[6 marks]**

(ii) Compute $f_s(1,-2)$ and $f_t(1,2)$ **[4 marks]**

Continued....

Question 4 (25 marks)

a) Integrate the following functions:

(i) $\int\left(2x+\frac{3}{x}+\frac{4}{x^2}\right)dx$ **[3 marks]**

(ii) $\int\left(2e^x-x^3\right)dx$ **[3 marks]**

(iii) $\int_1^2 1+\frac{1}{x}+e^x dx$ **[5 marks]**

b) Solve the following integral using integration by substitution:

$$\int_0^4 x\sqrt{9+x^2}\,dx$$

[7 marks]

c) Find the area of the region R under the graph of $f(x)=e^{\frac{1}{2}x}$ from $x = -1$ to $x = 1$.

[7 marks]

End of Page.

LIST OF FORMULAE

Linear & Quadratic Equation

1. **Quadratic Equation**

Solution of quadratic equation : $ax^2 + bx + c = 0$ are

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Mathematics for Finance

1. **Simple Interest**

Interest, I = Prt

Accumulated amount, A = P (1 + rt) or A = P + I

2. **Compound Interest**

$A = P(1 + i)^n$ where $i = \frac{r}{m}$ and $n = mt$

3. **Effective Rate of Interest**

$$r_{eff} = \left(1 + \frac{r}{m}\right)^m - 1$$

4. **Present Value for Compound Interest**

$$P = A(1+i)^{-n}$$

5. **Annuity**

$$S = R\left[\frac{(1+i)^n - 1}{i}\right] \qquad P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$

6. **Amortization**

$$R = \left[\frac{Pi}{1-(1+i)^{-n}}\right]$$

7. **Sinking Fund**

$$R = \left[\frac{iS}{(1+i)^n - 1}\right]$$

Derivative

Basic Rules of Differentiation

a) Derivative of a constant: $\frac{d}{dx}(c)=0$

b) Power rule: $\frac{d}{dx}(x^n)=nx^{n-1}$

c) Sum rule: $\frac{d}{dx}[f(x)\pm g(x)]=\frac{d}{dx}[f(x)]\pm\frac{d}{dx}[g(x)]$

a) Product rule: $\frac{d}{dx}[f(x)\bullet g(x)]=\frac{d}{dx}[f(x)]g(x)+\frac{d}{dx}[g(x)]f(x)$

b) Quotient rule: $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right]=\frac{g(x)\bullet\frac{d}{dx}[f(x)]-f(x)\bullet\frac{d}{dx}[g(x)]}{[g(x)]^2}$

c) Chain rule: $\frac{dy}{dx}=\frac{dy}{du}\bullet\frac{du}{dx}$

d) General Power rule: $\frac{d}{dx}[u^n]=nu^{n-1}\frac{d}{dx}u$

e) Logarithmic function: $\frac{d}{dx}(\ln u)=\frac{1}{u}\left(\frac{du}{dx}\right)$

f) Exponential function: $\frac{d}{dx}(e^u)=e^u\frac{du}{dx}$

Integration

Basic Rules of Integration

a) Indefinite integral of a constant: $\int k\,du = ku + C$

b) Power rule: $\int u^n\,du = \frac{u^{n+1}}{n+1}+C$

c) Sum rule: $\int [f(u) \pm g(u)]\,du = \int f(u)\,du \pm \int g(u)\,du$

d) Logarithmic function: $\int \frac{1}{u}\,du = \ln u + C$

e) Exponential function: $\int e^u\,du = e^u + C$

Calculus of Several Variables

1. **Determining Relative Extrema**

$D(x,y) = f_{xx}f_{yy} - f_{xy}^{\ 2}$

D(a,b)	$f_{xx}(a,b)$	Interpretation
+	+	Relative min. at (a,b)
+	–	Relative Max. at (a,b)
–		Neither max. or min. at (a,b)
0		Test is inconclusive

Others

1. **Average Cost Function**

$\overline{C} = \dfrac{C(x)}{x}$

2. **Marginal Average Cost Function**

$\overline{C}'(x)$